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L2: Entry 3 of 3 File: USPT Feb 10, 1998

DOCUMENT-IDENTIFIER: US 5717159 A
TITLE: Lead-free precussion primer mixes based on metastable interstitial composite (MIC) technology

Abstract Text (1):
A lead-free percussion primer composition and a percussion cup containing e composition. The lead-free percussion primer composition is comprised of a mixture of about 45 wt % aluminum powder having an outer coating of aluminum oxide and molybdenum trioxide powder or a mixture of about 50 wt % aluminum powder having an outer coating of aluminum oxide and polytetrafluoroethylene powder. The aluminum powder, molybdenum trioxide powder and polytetrafluoroethylene powder has a particle size of 0.1 .mu.m or less, more preferably a particle size of from about 200-500 angstroms.

Brief Summary Text (5):
This invention relates in general to lead-free percussion primer mixes for use in a primer cup assembly, and more particularly, to an improved primer mix based on metastable interstitial composite (hereinafter MIC) technology.

Brief Summary Text (7):
Conventional percussion primer mixes used in percussion cup assemblies for almost all calibers of ammunition utilize primer compositions based on lead styphnate, lead azide, antimony sulfide, barium nitrate and other materials that are environmentally objectionable. These primer compositions also require expensive handling procedures during both production and disposal. Several tons of these toxic materials and heavy metals are used annually by U.S. commercial suppliers in the production of percussion primer mixes. The human body has difficulty in removing lead that has been absorbed by the body and dissolved in the blood. Consequently, a primary concern is the amount of lead absorbed by humans from exposure to primer mix constituents, as well as the combustion by-products of lead-based primer compositions.

Brief Summary Text (8):
Primer mixes used in military ammunition must function reliably between the temperatures of -65.degree. F. to +160.degree. F. The reliability of current lead-free primer compounds degrade as temperatures approach -65.degree. F. The ability of a percussion primer to function reliably at low temperatures becomes particularly important when percussion primed ammunition is used in aircraft gun systems which are routinely exposed to severe cold.

Brief Summary Text (9):
A common non-lead primer composition currently being utilized is dinitrodiazophenol (hereinafter DINOL). The use of DINOL meets requirements for commercial applications, but it does not fully meet military requirements. Attempts in improving the reliability of such primers has resulted in an increase in the hazards associated with their use in U.S. military weapons.

Brief Summary Text (10):
Many commercial manufacturers of primers are currently involved in the development and testing of new energetic materials for use in primers for small caliber ammunition. However, none of the new primer mixes meet the requirements imposed for use in military applications.

Brief Summary Text (12):
It is therefore an object of the present invention to provide for a percussion cup an improved primer mix which has little dependence on temperature and is reliable at low

temperatures.

Brief Summary Text (13):
It is another object of the invention to provide for a percussion cup an improved primer composition which does not contain toxic materials and whose by-products are non-toxic and environmentally benign.

Brief Summary Text (15):
According to the present invention there is provided an improved lead-free percussion primer composition comprising particulate aluminum and molybdenum trioxide having a particle size of about 0.1 .mu.m or less. The molybdenum trioxide is present in an amount sufficient to oxidize the aluminum particles.

Brief Summary Text (17):
In another embodiment of the present invention, a lead-free percussion primer composition comprises particulate aluminum and polytetrafluoroethylene having a particulate size of about 0.1 .mu.m or less.

Brief Summary Text (18):
Where the primer composition according to the present invention comprises aluminum and molybdenum, it is preferred that the aluminum constitute about 45 wt % of the composition. When the primer composition of the present invention comprises particulate aluminum and TEFLON, the aluminum constitutes about 50 wt % of the composition.

Drawing Description Text (2):
FIG. 1 is a cross sectional view of a primer cup assembly illustrating the placement of the primer compositions of the present invention.

Detailed Description Text (2):
A primer cup assembly conventionally used in ammunition is shown generally at 1 (FIG. 1) and comprises a brass primer cup 3 having a rim portion 5. The primer cup portion 3 contains a primer mix 7. A paper disc 9 rests on the surface of primer mix 7 so as to contain primer mix 7 in said primer cup assembly 3 and to prevent moisture from reaching the primer mix 7. A saddle shaped anvil indicated generally at 10 is shown with a top surface 4 and a cross sectional area 13. The anvil 10 rests upon and is in contact with paper disc 9.

Detailed Description Text (3):
The percussion primer composition of the present invention, unlike the commonly used lead-based explosive compositions which detonate, react together and cause an extremely intense exothermic reaction. This reaction liberates a great amount of heat and burning particles which causes the main charge of gun powder in the ammunition to ignite and rapidly burn.

Detailed Description Text (4):
In a preferred embodiment of the invention, the percussion primer composition 7 is a mixture of aluminum powder and molybdenum trioxide or a mixture of aluminum powder and Teflon (polytetrafluoroethylene). The particle sizes of the powder is preferably about 0.1 .mu.m or less, more preferably from about 0.02-0.05 .mu.m. For the Al/MoO.sub.3 combination, aluminum typically constitutes about 45 wt % and MoO.sub.3 typically constitutes about 55 wt % of the composition. Weight percentages for the Al/Teflon combination are about 50 wt % for each of the species.

Detailed Description Text (5):
The by-products of the reaction of aluminum and molybdenum trioxide consists of alumina (a ceramic) and molybdenum, both non-toxic and environmentally benign. A substitute, lead-free, primer mix would also have to provide the same or greater performance (energy output) and reliability under stated conditions (-65.degree. F. to +160.degree. F., total propellant ignition). MIC materials satisfy these requirements.

Detailed Description Text (6):
The primer compositions of the present invention provide a significant increase in output energy as compared to a standard primer mix and can be tailored to provide optimal performance. Thus, the primer composition of the present invention provides greater performance in primer mix performance while maintaining the current design of existing percussion primers. This eliminates the need to redesign the primer and associated components. The relative insensitivity of the primer compositions of the present invention to low temperatures provides a primer mix that will reliably function at temperatures as low as -65.degree. F. With a cook off temperature that approaches

900.degree. F., these compositions far exceed the required high temperature requirement of +160.degree. F. for the safe use of military ammunition.

Current US Class (1):
102

CLAIMS:

1. A lead-free percussion primer composition comprising:

a mixture of aluminum powder and molybdenum trioxide powder,

wherein said aluminum powder and said molybdenum trioxide have a particle size of about 0.1 .mu.m or less, and said aluminum powder has an outer coating of aluminum oxide.

2. The lead-free percussion primer composition of claim 1, wherein said aluminum and molybdenum powder has a particle size of from about 200-500 angstroms.

3. The lead-free percussion primer composition of claim 1, wherein molybdenum trioxide is present in an amount sufficient to oxidize said aluminum powder.

4. The lead-free percussion primer composition of claim 1, further comprising powdered polytetrafluoroethylene.

5. A lead-free percussion primer composition comprising particulate aluminum and polytetrafluoroethylene having a particle size of 0.1 .mu.m or less, wherein said particulate aluminum has a coating thereon of aluminum oxide.

6. The lead-free percussion primer composition of claim 5, wherein the particle size is from about 200-500 angstroms.

7. The lead-free percussion primer composition of claim 1 wherein the aluminum powder constitutes about 45 wt %.

8. The lead-free percussion primer composition of claim 5, wherein the aluminum powder constitutes about 50 wt %.

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L7: Entry 13 of 26 File: USPT Nov 30, 1993

DOCUMENT-IDENTIFIER: US 5266132 A
TITLE: Energetic composites

Abstract Text (1):
A method for providing chemical energy and energetic compositions of matter consisting of thin layers of substances which will exothermically react with one another. The layers of reactive substances are separated by thin layers of a buffer material which prevents the reactions from taking place until the desired time. The reactions are triggered by an external agent, such as mechanical stress or an electric spark. The compositions are known as metastable interstitial composites (MICs). This class of compositions includes materials which have not previously been capable of use as energetic materials. The speed and products of the reactions can be varied to suit the application.

Brief Summary Text (1):
A composition of this invention is termed a metastable interstitial composite (MIC). MICs are a new class of energetic materials which provide much more flexibility in their use than unimolecular energetic materials. MICs will be useful in explosives applications and in applications where a source of gas or heat is needed.

Brief Summary Text (5):
This invention is a method for providing chemical energy and energetic compositions of matter consisting of thin layers of substances which will exothermically react with one another. The layers of reactive substances are separated by thin layers of a buffer material which prevents the reactions from taking place until the desired time. The reactions are triggered by an external agent, such as mechanical stress or an electric spark. The compositions are known as metastable interstitial composites (MICs). This class of compositions includes materials which have not previously been capable of use as energetic materials. The speed and products of the reactions can be varied to suit the application.

Current US Class (1):
149

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